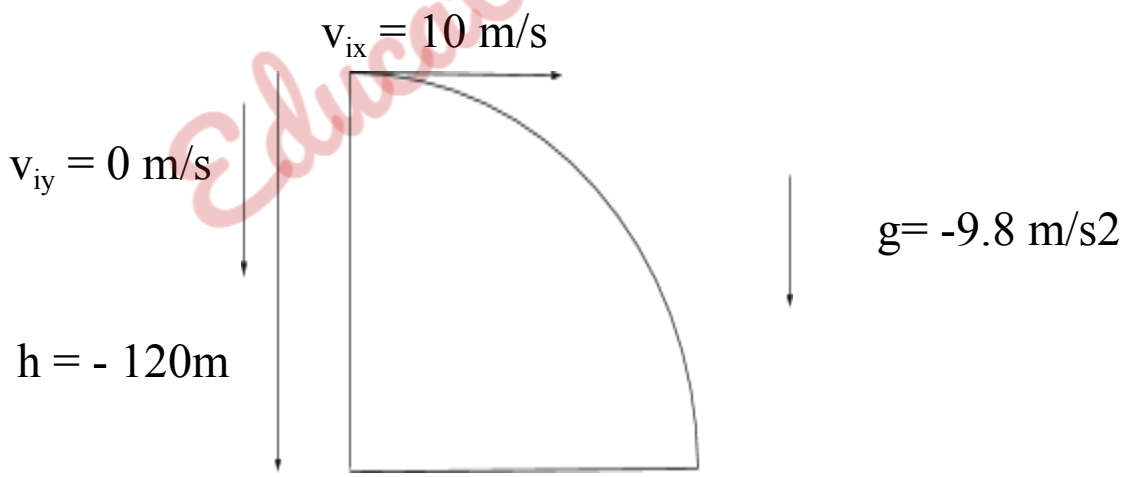
A rock is projected horizontally from a cliff of height 120m with an initial velocity of 10 m/s. Calculate the horizontal distance traveled by the rock from the time it was projected from the cliff to the time it strikes the ground.



Given:

Displacement of rock in the downward direction: h = - 120m

Acceleration is acceleration due to gravity acting in the downward direction: g = - 9.8 m/s2

Horizontal component of initial velocity: v_{ix} = 10 m/s

Vertical component of initial velocity: v_{iy} = 0 m/s

Since g acts vertically downward, it affects only v_{iy} and v_{ix} remains the same throughout the motion.

Determine: horizontal distance traveled by the rock: X

Use equation:

$$X = v_{ix}(\Delta t) \text{ ----------(1)}$$

Time taken, Δt, by the rock to strike tie ground from the time it is projected is unknown. To find Δt, use equation of motion:

$$h = v_{iy}(\Delta t) + \tfrac{1}{2}(g)(\Delta t)^2 \text{ ----------(2)}$$

Substituting for h, v_{iy}, and g in (2):

$$-120 = (0)(\Delta t) = \tfrac{1}{2}(-9.8)(\Delta t)^2$$

$$\Delta t^2 = -120*2 / (-9.8) = 24.49\ s^2$$

$$\Delta t = 4.95\ s$$

Substituting v_{ix} and Δt in (1):

X = 10* 4.95 = 49.5m